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This serial publication contains articles, abstracts of articles and news items from USSR scientific and technical journals on the specific subjects reflected in the table of contents.

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HIGH-PRECISION BEARING MACHINING EQUIPMENT DEVELOPED

Moscow IZVESTIYA SOVETOV NARODNYKH DEPUTATOV in Russian 15 Jul 79, p 2

[Article by Dr of Technical Sciences A. Murashkin. Professor at the Technical Institute imeni M. I. Kalinin, Leningrad: "Superhigh Precision"]

[Text] The development of instrument making for new types of equipment has required a sharp expansion of the country's output of the small-sized bearings which are called "instrument bearings." Extremely exacting requirements regarding precision of rotation, noise characteristics and other important parameters are imposed on such bearings. The main parts which determine the quality of the bearing, the inner and outer rings, are manufactured with a precision to within 2/10,000 of a millimeter, and their working surfaces are ground to a mirror finish.

Until recently this country produced no machine tools for machining the rings which could achieve the required degree of precision. Moreover, there were no stable processes making it possible even to approach the required machining accuracy. The collectives of many scientific research and production organizations worked on the development of such machine tools, including the Special Design Bureau for Grinding Equipment, the plant imeni Il'ich of the Machine Building Association imeni Sverdlov and the All-Union Scientific Research Institute of Abrasives and Grinding (VNIIASH), all of Leningrad.

No less complex tasks had to be accomplished by the workers, foremen and production organizers in mastering the series production of the machine tools. Nor was it simple to put the new equipment into operation and to improve it further.

The level of responsibility was high. The assignments for increasing production of instrument bearings and equipment for their manufacture are set out in the document "Main Directions of Development of the USSR National Economy in 1976-1980." Mastery of the series production of the equipment was included in the socialist commitments of Leningrad and Leningradskaya Oblast.

Today, this extremely important problem has been solved. Highly effective equipment that gives the required machining precision at the current state of the

art, i.e. with complete process automation and high output, has been developed, put into series production, and placed in operation. All of the machine tools have been awarded the pentagon of honor: the state seal of quality.

This work was based on comprehensive use of the current achievements of science and technology. Ultrasonic vibrations were used, making it possible to achieve stability and controllability of the machining of the rings with diamond abrasive sticks. The same vibrations, applied to the supports on which the rings are rotated during machining, made it possible to decrease the force of friction between the ring and the support by a factor of 100. Extremely precise spindle units were developed.

Optical methods were successfully used to adjust the machine tools and to observe the course of the process in an extremely limited working space.

Many of the engineering solutions have been recognized as inventions. The 13 author's certificates received by participants in the work both indicate the novel character of the problem to be solved and show the high scientific and technical level of the designs themselves.

The design of the new machine tools and their successful series production have made it possible to accomplish an important national-economic task. It is now unnecessary to import similar equipment from abroad, since it is now inferior in precision to domestically-produced machines. The results achieved during the work may be applied--and are already being successfully applied--to the solution of other problems of the finishing of metal parts. It suffices to say that the Special Design Bureau for Grinding Equipment is completing development of a high-precision automatic machine tool for grinding small-diameter drill bits, and the designers of the plant imeni Il'ich have undertaken to develop, at the request of the medical profession, a machine tool for grinding precision miniature parts for "artificial hearts."

8480

CSO: 1861

FLEXIBLE BEARING SURFACE DEVELOPED FOR TURBINES

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 30 Jun 79

[Article by A. Vorob'yev: "Soft Bearings"]

[Text] The bearings laboratory of the Kuybyshev Aviation Institute imeni S. P. Korolev. On the walls are sheets bearing drawings and diagrams: powerful hydraulic units installed in the Volzhskaya, Saratovskaya, Bratskaya and other GES. I asked group leader Docent Yu. Bayborodov how aviation problems have come to have something in common with hydraulic engineering.

"In the first place, the friction against which science is struggling operates according to the same rules in aviation as in hydraulic machinery," answered Yuriy Ivanovich. "And in the second place, scientists frequently get engrossed by ideas and problems which are not necessarily directly connected with their own areas of work."

"But how did you get involved in improving the design of such things as hydraulic units?"

"For two decades now, scientists and designers have been trying to solve an engineering problem which at first glance seems rather narrow: how to make the step bearing of a hydraulic unit--a unique, gigantic sliding bearing--durable and reliable," answered the group leader.

As Yuriy Ivanovich explained, a step bearing enclosed in an oil bath will work properly and for a long time if the unit is not stopped. But hydroelectric power stations are used for continuous regulation of the load on a power system and compensation of peak situations. This requires that the units be switched on and off frequently. After 10 to 20 startups of the turbine, the step bearing of the hydraulic generator becomes damaged, the pivot surface becomes scored, and the bearing metal approaches its melting point. The unit has to be stopped for repairs.

At the request of the collective of the Volzhskaya GES imeni V. I. Lenin, the people at Kuybyshev set themselves the goal of developing a new segmented design which would assure reliable operation of hydroelectric units under any

operating conditions. Research indicated that the main cause of breakdown is corrugation in the pivot surface of the unit (machine builders have thus far been unable to obtain an ideal even surface over so great an area).

The scientists reasoned as follows: if the corrugation creates large local stresses, the so-called "elastic effect" must be forced to operate in this location. That is, the surface of the segment must be made elastically deformable: then it will mold itself, so to speak, to the pivot surface and the stress in the contact zone will decrease sharply. In addition, the high antifriction properties of the new coating, a fluoroplastic, protect the pivot surface from damage.

The new elastic segment design was tested for four years on an analogous device, a vacuum pump. The loads were increased gradually and finally reached the level of those on the step bearing. But everything went smoothly. Next the management of the Volzhskaya GES decided to conduct production testing of the "soft bearing" in the ninth hydroelectric unit.

An experimental set of step bearing segments was manufactured in the station's workshops. Much inventiveness and effort was shown by the brigades of fitters and assemblers led by L. Tyurin and V. Kirpichnikov. And soon the 25th startup of the turbine was past. On inspection, the surface of the segments showed neither incipient melting nor galling of the material. The step bearing worked properly under all the unit's operating conditions.

Now the new step bearings are operating reliably in individual units of the Volzhskaya and Saratovskaya GES. Not long ago the innovation passed its tests in Bratsk and Ust'-Il'msk. It would seem that now it should be disseminated rapidly. About 40 hydroelectric stations in the country need better step bearings. According to data from Soyuztekhnenergo [power equipment organization], the economic effect resulting from putting this Kuybyshev development into operation in existing GES would amount to 8.5 million rubles per year.

But how is its introduction proceeding? Here is what A. Romanov, director of the Volzhskaya GES imeni V. I. Lenin, says:

"Three of our units are already equipped with the new bearings. They are working ideally under all conditions. They have a further effect: the new step bearings are increasing the individual capacities of the hydraulic units by decreasing friction by 300-400 kW. We described our experience using them to the scientific and technical council of the Ministry of Power and Electrification back in 1976. A good decision was adopted: to arrange series production of the new step bearings at the Cheboksary Energozapchast' [power equipment spare parts] plant. But to date it has not been implemented.

Is it possible that the developers could be the ones at fault? Could they be doing a bad job of assisting in the mastery of the new product? No; for the institute has given the Energozapchast' plant and the Uralelektrotyazhmash [heavy electrical equipment] production association the production process for the segments. These enterprises, together with the Kuybyshev Aviation Institute,

have developed and manufactured the tooling and accessories for production of the segments. But everything has bogged down at this point.

It would seem that such an undertaking should not remain merely a matter of enthusiasm. The USSR Ministry of Power and Electrification should, in the interest of the country's national economy (and in its own interest), implement the production of the scientists' invention, which has already been tested in practice.

8480

CSO: 1861

NON-NUCLEAR ENERGY

UNDERGROUND STORAGE OF DIESEL FUEL IN PERMAFROST

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 14 Sep 79, p 4

[Article datelined Yakutsk: "Preservation Guaranteed"]

[Text] In the permafrost region it is possible to build reservoirs of almost any size, according to scientists of the Institute of Permafrost Studies, Siberian Department of the Academy of Sciences USSR.

An underground cistern with a capacity of 2000 tons of diesel fuel was built on the grounds of the institute on an experimental basis. The fuel retained its properties in an excellent manner over the period of one year.

It took only three weeks to build the cistern. A well 20 meters deep was first bored. A rotating hydromonitor centrifugally dispersed the sand which was pumped out to the surface together with the water. The experimental cistern has a diameter of 16 meters and a depth of 10 meters. The "roof" had the same thickness [10 meters]. Clean water was then pumped into the opening for a short time. This coated the walls of the cistern with a "stucco coating" of ice 5-7 centimeters thick.

The director of the institute, Corresponding Member USSR Academy of Sciences P. Mel'nikov stated to TASS correspondent D. Bubyakin that "there are many different ways of utilizing the beneficial properties of permafrost. We experimentally stored vegetables and potatoes in a special pit. Losses comprised only two percent. The advantages of underground storage of vegetables are apparent: care is very simple, and the labor expended for building and servicing is insignificant. The decrease in spoilage and the preservation of quality in vegetables will to a great extent satisfy the growing demands for food products by consumers in the northern regions."

CSO: 1861

USSR

UDC 533.6

GAS-DYNAMIC CALCULATION OF AN EXPLOSIVE PLASMA GENERATOR

Minsk DOKLADY AKADEMII NAUK BSSR in Russian Vol 23, No 8, 1979 pp 705-709
manuscript received 16 Jan 79

ROMANOV, G. I. and URBAN, V. V., Scientific Research Institute of Applied Physics Problems at Belorussian State University imeni V. I. Lenin

[Abstract] A numerical model is developed for the gas-dynamic processes that take place in a Voytenko plasma generator [A. Ye. Voytenko, "Doklady Akademii nauk SSSR," Vol 158, No 6, 1964, p 1278]. The analysis is based on an eulerian representation of the equations of gas dynamics in a cylindrical coordinate system, using a "coarse particle" method [O. M. Belotserkovskiy, Yu. M. Davydov, "Zhurnal vychislitel'noy matematiki i matematicheskoy fiziki (ZhVMiMF)," Vol 11, No 1, 1971, p 182; Yu. M. Davydov, "ZhVMiMF," Vol 11, No 4, 1971, p 1069] for numerical solution. An investigation is made of the pattern of three-dimensional motion of shock waves in the working chamber, and of the distinguishing features of gas-dynamic movement of the plasma in the generator, and the results are compared with experimental data. The theoretical flow patterns show good agreement with experiment. The authors thank R. I. Soloukhin for support, and A. Ye. Voytenko, A. A. Deribas and V. I. Kirko for the discussion that prompted this work. Figures 2 references 14: 11 Russian, 3 Western.

[304-6610]

USSR

PROPAGATION OF WEAK WAVES THROUGH A RELAXING GAS-LIQUID MIXTURE

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR, MEKHANIKA in Russian Vol 32, No 2, Mar-Apr 79 pp 3-13 manuscript received 12 Jul 78

OGANYAN, G. G., Institute of Mechanics, Academy of Sciences of the Armenian SSR

[Abstract] Transient propagation of a weak three-dimensional wave through a mixture of chemically active fluids is considered when such a mixture contains gas bubbles which could have been produced by a strong acoustic wave. The fundamental equations are applied to the case of only one chemical reaction taking place in a mixture of viscous fluids with stable small gas bubbles of one size, this reaction being characterized by its degree of completion. The statistical distribution of

bubbles is disregarded, assuming that both phases move at the same velocity, and the distance between bubbles is assumed to be much larger than their radius so that interaction between them can also be disregarded. The system of equations describing the flow of such a gas-liquid mixture is closed by adding the Gibbs relation and solved for a shock wave of low but finite intensity propagating in one direction, with dissipation and relaxation at the wave front taken into account. A solution is obtained first for a quasi-equilibrium process and then for a quasi-frozen process. The relation between the acoustic velocities in these two cases is derived from thermodynamics and applied to two media with nearly equal acoustic velocities. A chemically inert gas-liquid mixture is a special case. A two-dimensional problem is also a special case, which is solved here in the linear approximation. References 12: 9 Russian, 3 Western.

[389-2415]

USSR

UDC 536.24.532.517.4

EXPERIMENTAL INVESTIGATION OF HYDRODYNAMIC DRAG AND HEAT TRANSFER WITH AXIAL FLOW OF FLUIDS IN THE ANNULUS AROUND AN INNER ROTATING CYLINDER

Mirok IZVESTIYA AKADEMII NAUK BSSR, SERIYA FIZIKO-ENERGETICHESKIKH NAUK in Russian No 3, 1979 pp 97-102 manuscript received 7 Mar 78

MOSYAK, A. A., RYKOVA, B. G., GRUZINTSEV, G. I. and KOSTOV, P. D., Kishinev, Special Technological Design Office of Sealed and Well Pumps

[Abstract] The design and calculation of electrical pumps for liquid heat transfer agents involve, among other complex problems, determining the optimal method of motor cooling. This requires knowledge of the pattern of variation in the coefficient of heat transfer during the flow of a fluid in the annular gap between the rotor and the stator. In this connection, heat transfer from the surface of a fixed outer cylinder was experimentally investigated in the presence of the flow of a fluid in the annular gap between that cylinder and an inner rotating cylinder, for two gap widths, $\delta/r_1 = 0.0174$ and 3.38 . The experiments were performed on a set-up represented by a fluid-filled electrically heated closed circuit containing as its principal components a rotor and a stator separated by an annular clearance. In addition, hydrodynamic drag of the fluid flowing in the annular clearance was calculated for a series of Reynolds numbers with allowance for both axial and rotational flow. For $Re_0 > 10^4$ the dependence of the drag coefficient on the effective Reynolds number within the range of variation in the ratio of effective flow velocity to axial flow velocity $V_e/V_a = 1.3-20.5$ can be

described by a single curve for up to $Re_e = 3.6 \cdot 10^4$. Compared with the wide annular clearance of ($\delta/r_1 = 3.38$), the narrow clearance ($\delta/r_1 = 0.0174$) markedly reduces heat transfer from the stator sleeve, since then the transport of heat by forced convection is much lower and the development of large-scale flow eddies is impeded. Figures 5; references 5: 1 Russian, 4 Western.

[399-1386]

USSR

UDC 533.6.011

SUPERSONIC FLOW AROUND A POINTED SMOOTH AIRFOIL

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43, No 3, 1979
pp 480-488 manuscript received 19 Apr 78

FADVOGIN, YU. B., Moscow

[Abstract] The local flow structure in the neighborhood of a singular point during the supersonic flow of an inviscid thermally nonconductive gas around a pointed smooth airfoil is investigated in the presence of a shock wave at the leading edge. Gas-dynamic functions are represented as $f + f_0 + f_1 + o(f_1)$, where f_0 corresponds to flow around an infinite rectilinear wedge with an attached planar shock waves. Linearization with respect to f_0 results in a boundary-value problem for the angle of turn of the flow. Its solution is written out in explicit form and the properties of that solution are investigated. It is shown that if f_0 corresponds to supersonic flow then $f_1 = 0$. The case of subsonic flow results in a sequence of nonzero eigenfunctions $f_1^{(m)}$. The transsonic treatment of the first $f_1^{(m)}$ is presented. The difference between "strong" and "weak" shock waves is established. The investigation is performed both for the homogeneous case (rectilinear profile, uniform incident flow) and for the inhomogeneous case (local linearity of flow). Figures 2; references 6: 4 Russian, 2 Western.

[318-1386]

DYNAMICS OF THE CLOSING OF PORES ON A SHOCK WAVE FRONT

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43, No 3, 1979
pp 511-518 manuscript received 17 Apr 78

DUNIN, S. Z. and SURKOV, V. V., Moscow

[Abstract] Features of the propagation of plastic shock waves in porous media are analyzed on the basis of the equation of state of a homogeneous medium with identical spherical pores with allowance for the dynamics of the plastic closing of pores and the viscous properties of the medium, as well as with allowance for the equations of motion and of conservation of mass. The effect of shock wave velocity, viscosity, yield point, and porosity on the pattern of wave propagation is investigated. The condition for existence of shock waves is derived. Ranges of values of parameters at which complete plastic closing of pores at the wave front takes place are derived, as are ranges of partial sampling of the pore space. The behavior of shock adiabats is analyzed as a function of the strength and viscosity properties of the porous medium. It is found that the dynamics of the propagation and attenuation of shock waves of not too high intensity (of the order of tens of kilobars for porous solids) is largely conditioned by the pattern of the filling of cavities (in solids at these pressures this is represented by the state of plastic flow). In the case of propagation of weak-intensity waves the irreversible nature of the loading-unloading diagram is essential, as this pattern provides an additional mechanism of wave attenuation (in addition to viscosity and heat conduction) for such waves. Figures 4; references 11: 7 Russian 4 Western.

[218-1386]

THE PLANAR TURBULENT WAKE IN THE LIGHT OF THE GENERALIZED KARMAN THEORY

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43, No 3, 1979
pp 558-563 manuscript received 27 May 78

NOVOZHNIKOV, V. V., Leningrad

[Abstract] This is a continuation of earlier investigations (Novozhilov, V. V., VESTN. LGU. SER. MATEM., MEKhan., ASTRON., No 13, 1976; "teoriya ploskogo turbulentnogo pogrannichnogo sloya neszhimayemoy zhidkosti" [Theory of the Planar Turbulent Boundary Layer of Incompressible Fluids],

Leningrad, Sudostroveniya, 1977), with the difference that the formula previously proposed for tangential Reynolds stresses with respect to planar turbulent boundary flow is now extended to the problem of the planar turbulent wake in the region of its self-similarity. It is shown that this formula is transformable to the general Karman formula which previously could not be applied to problems of free turbulence of reflection points on the velocity profiles of jets and wakes, and that this assumption produces results sufficiently close to experimental findings. In particular, the empirical constant that is part of the universal logarithmic law, and that previously had been derived on the basis of experiments with flow in tubes or boundary layers, can now be determined (and correct to as little as 5%) on the basis of measurements of the width of turbulent wakes. Figures 2; references 3 Russian.

[318-1386]

USSR

UDC 532.593

"CONDITION ON AN EDGE" IN THE LINEAR THEORY OF LONG SURFACE WAVES

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA Vol 43, No 3, 1979 pp 564-566

PLIS, V. I., Moscow

[Abstract] The asymptotic behavior of the form of the surface of an ideal fluid in the neighborhood of the edge of a two-dimensional wedge is investigated on the basis of the requirement of finiteness of the kinetic energy stored in an arbitrary finite volume of fluid moving in the neighborhood of the edge. This is connected with the so-called condition at the edge which applies in certain problems of the theory of wave motions in the presence of non-smooth boundaries (edges), e.g. when the region considered is bounded by a non-smooth surface. In such cases, several different mathematically correct solutions are derived, but of these only one faithfully describes the investigated physical phenomenon. Then, to assure uniqueness, an additional physical constraint must be introduced. It is proposed that the requirement of finiteness of kinetic energy in any finite volume of fluid be adopted as such a constraint, and that this be termed the "condition on the edge." It is shown that, on the basis of the linear theory of long surface waves, the condition on the edge can be derived for waves in a basin of constant depth that rotates uniformly about an axis directed along the edge of an absolutely rigid two-dimensional wedge. The proposed procedure can also be used to calculate the order of singularity in the case that the basin is at rest on assuming the Coriolis and centrifugal forces to be zero. Figures 1; references 3 Russian.

[318-1386]

UNSTEADY OPERATING MODES OF AN ISOTHERMAL REACTOR WITH LONGITUDINAL MIXING

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43, No 3, 1979
pp 566-569 manuscript received 12 Jul 78

NOVIKOV, V. A., Moscow

[Abstract] A formula for the effectiveness of a chemical reactor operating in the dynamic mode is derived with respect to a tubular isothermal reactor in which a single irreversible chemical reaction takes place. Since there is no exact analytic solution for the problem of the unsteady-state distribution of concentration in a tubular isothermal reactor with longitudinal dispersion, in the presence of a perturbation at the inlet, an approximate solution of the problem is constructed with the aid of the perturbation theory. The resulting approximate analytic solution makes it possible to investigate the influence that unsteady-state perturbations in the concentration present in the inlet flow have on the time-averaged rate of conversion of the reagent in the reactor, and to compare it with the steady-state rate of conversion in a reactor with ideal mixing. References 14: 1 Russian, 13 Western.

[318-1386]

LINEAR MECHANICS OF COILED PIPES

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43, No 3, 1979
pp 569-574 manuscript received 18 Nov 77

GORDIYENKO, B. A., Kuybyshev

[Abstract] Linear equations of motion are derived for curved flexible pipes conveying a viscous incompressible fluid in unsteady-state flow. Allowance is made for such factors as rotational inertia and the shear deformation of the pipe, the friction of fluid against the internal surface of the pipe, and the flow pressure. The problem is solved in its linear statement on assuming nondeformability of the pipe contour. Formulas for the kinetic and potential energies of the piping are derived in dimensionless form. The linear equations of motion derived for the curved pipes are of the hyperbolic type and hence can be used not only to investigate standard classical oscillations but also to analyze the wave processes associated with the unsteady-state deformation of pipes. Such an approach admits the construction of more exact theories. Figures 1; references 13: 8 Russian, 5 Western.

[318-1386]

STREAMLINE FLOW AROUND BLUNT BODIES ERODING UNDER INTENSIVE RADIANT HEAT DURING THEIR MOTION IN A HYDROGEN-HELIUM ATMOSPHERE

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3, May-Jun 79
pp 539-543 manuscript received 14 Jul 78

MIRSKIY, V. N., Institute of Mechanics, Moscow State University

[Abstract] The problem of space probes entering the atmosphere of planets, at velocities up to 60 km/s, is considered in terms of radiation gas dynamics. The analysis is based on the equations of heat transfer by radiation and mass transfer by evaporation, disregarding both diffusion and heat conduction. The contact surface divides the region of perturbed flow at the body into two layers, with the oncoming stream assumed to be homogeneous and the outgoing shock wave subject to the Hugoniot conditions. The problem has been solved numerically by the Euler method for a phenol-impregnated carbon sphere with a 1 m radius and an equivalent boundary layer accounting for viscosity in a hot supersonic stream of a hydrogen-helium mixture containing electrons. The absorption coefficients for this gas mixture were calculated taking into account photoionization of both elements as well as bremsstrahlung in fields of neutral particles and of ions. The trajectories of the body were calculated disregarding the gravitational forces but taking into account deceleration with wear by sublimation. Figures 6; references 10: 9 Russian, 1 Western.

[385-2415]

FLOW OF A VISCOUS FLUID AROUND INCLINED UNSTAGGERED TUBE BUNDLES, AND THE FLOW-INDUCED VIBRATIONS

Vil'nyus TRUDY AKADEMII NAUK LITOVSKOY SSR SERIYA B: KHIMIYA, TEKHNIKA, FIZICHESKAYA GEOGRAFIYA in Russian No 3 (112), 1979 pp 101-112 manuscript received 12 May 78

ZHUKAUSKAS, A. A., KATINAS, V. I., PEREDNIS, E. E. and SOBOLEV, V. A.,
Institute of Physicotechnical Problems of Power Engineering, Academy
of Sciences Lithuanian SSR

[Abstract] An investigation is made of vibrations of tube bundles that are inclined to the direction of flow, the curves for amplitude of vibrations as a function of flow velocity are analyzed, the physical aspect of the flow-induced vibration is considered, and methods are proposed for

eliminating these vibrations. The research is based on transverse flow of water around unstaggered tube bundles with relative spacing 1.34×1.4 , where the angles of inclination of the tubes to the direction of flow are 25, 40, 60 and 75° at Reynolds numbers ranging from $2 \cdot 10^3$ to 10^5 . It was found that tube vibration arises under the effect of a pulsating hydrodynamic force set up due to pressure pulsations in the space between the tubes as the water flows around them. The maximum vibrations are observed in the first row of the bundle, and vibrations are greater in all rows along the flow than across the flow. For a damping constant of 0.25 or less, the maximum dimensionless flow velocity $U_{\max}/f_n d = 3.5$, where U_{\max} is the measured maximum flowrate, f_n is the frequency of the vibrations, and d is the outside diameter of the pipe. To avoid breakage in designing vibration-proof tube bundles, this figure should be reduced to 3 for α of 40° or more, and to 2.7 for α greater than 40°. Figures 10, references 7: 3 Russian, 4 Western.

[305-6610]

USSR

UDC 533.6.011.55.011.6

A TECHNIQUE FOR APPROXIMATE DETERMINATION OF THE REGION DISTURBED BY A BODY MOVING AT HYPERSONIC VELOCITY

Leningrad VESTNIK LENINGRADSKOGO UNIVERSITETA: MATEMATIKA, MEKHANIKA, ASTRONOMIYA in Russian No 2, Apr 79 pp 69-74 manuscript received 7 Nov 77

POLYANSKIY, A. F., SKURIN, L. I. and YURKOV, A. V.

[Abstract] An examination is made of the problem of determining the region disturbed by a body moving a high hypersonic velocity with consideration of the nonequilibrium nature of physicochemical processes, and a method is proposed for calculating this region of disturbance with regard to the actual properties of gases: departure of physicochemical transformations from equilibrium; viscosity, heat conduction, and diffusion close to the lateral surface and in the far wake; abrupt pressure drop near the base section; effects of viscous deceleration of the gas and reduction of total enthalpy in the near wake. The flow model is based on dividing the disturbed region into viscous and inviscid parts. The viscous part of the region includes the boundary layer, which is calculated with consideration of the inhomogeneity of the inviscid flow, and also includes the near wake and the far wake. The far wake includes a laminar and a turbulent region and is calculated by the net-point method. The pressure in the wake is determined by a method of characteristics. Calculations on the drop in electron density behind models moving in air at a Mach number of about 20 agree satisfactorily with available experimental data. Figures 4, references 14: 7 Russian, 7 Western.

USSR

UDC 543.43

ANALYSIS OF NOISE OF OPTICO-MECHANICAL SCANNING DEVICES

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 11-13 manuscript received 16 Oct 78

GOS'KOV, P. I., ZAMYATIN, N. V., ZINOV'YEV, G. G. and FREY, L. E.

[Abstract] Optico-mechanical devices are widely used for the scanning of luminous objects. A widely used scanning element in these devices is a disk with slots in the configuration of an Archimedean spiral. The use of devices with such disk-type scanning elements causes noise due to such factors as irregular width of the scanning slit, displacement of the center of the slit relative to the Archimedean spiral, the band characteristic of the photosensor, the internal noise of the photosensor, the vibration of the scanning element, and the background illumination of the device. Estimation of all the noise components serves to derive the signal/noise ratio determining the threshold sensitivity of the instrument. That ratio is determined as a function of the energy spectra of the signal and noise. A formula for the signal spectrum is presented. As for the energy spectrum of noise, it is determined separately for each noise component; corresponding formulas are presented. Analysis of the resultant spectra of signal and noise shows that the principal component of the system's noise is the shot noise of the photomultiplier; the corresponding signal/noise ratio is derived as a function of the luminous flux. Figure 1; references 3 Russian.

[396-1386]

USSR

UDC 621.391.2

EFFECTIVENESS OF DETECTION OF REFLECTED OPTICAL SIGNALS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 17-19 manuscript received 31 Jan 78

LEBED'KO, YE. G. and TIMOFEYEV, O. P.

[Abstract] The operating range of pulsed opto-electronic system (OES) can be augmented by means of energy similarity conversion consisting in increasing the amplitude of a pulse of a given energy while at the same time reducing its duration. It is shown that, proceeding from the premise of a gaussian statistic of the noise against whose background signal detection is performed, the effectiveness of energy similarity conversion can be characterized by the extent of the change in the signal/noise

ratio in the presence of optimal filtration. That ratio determines the energy gain due to reducing the duration of the probing pulse. Calculations of the energy gain due to reducing pulse duration from 100 to 10 ns while illuminating a real large object of complex configuration show that it varies from 1.1 to 2.53 depending on the viewing angle, thus serving to extend the operating range of inertialess pulsed OES. Formulas allowing for the inertia of the photoreceiving circuit are presented. Figures 2; references 4 Russian.

[396-1386]

ISSR

UDC 535.853.3

HOLOGRAPHIC DIFFRACTION GRATINGS FOCUSING PARALLEL PENCILS OF RAYS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 23-23 manuscript received 8 Aug 78

PEYSAKHSON, I. V.

[Abstract] The solution of some spectroscopic problems involves the investigation of the radiation of distant sources. In such cases the spectroscopic instrument is used without a collimator lens. The recent development of the holographic (interference) method of producing gratings has unlocked new prospects for using systems with insertion of gratings in parallel pencils of rays. In this connection, it is shown that the use of flat and concave holographic diffraction gratings can be effective in research into the spectra of remote radiation sources in cases in which high resolution within a relatively narrow range of wavelengths and in the presence of a high luminosity is required. The proposed computational method eliminates astigmatism and all other aberrations in the system, thus assuring a stigmatic image of an infinitely distant point at the center of curvature of the grating. Figures 3; references 3: 1 Russian, 2 Western.

[396-1386]

A PULSED CO_2 LASER WITH CONTINUOUS TUNING OF RADIATION FREQUENCY

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 25-28 manuscript received 5 Jul 78

MAZURENKO, YU. T., RUBINOV, YU. A., and SHAKHEVERDOV, P. A.

[Abstract] Pulsed CO_2 lasers with tunable frequencies within the 900-1100 cm^{-1} range represent a new promising source of applications in experimental high-resolution spectroscopy, oriented initiation of chemical reactions, and selective irradiation of matter. Currently atmospheric-pressure CO_2 lasers have become widespread: they are distinguished by their simplicity, but their frequency tuning is of the discrete kind. Hence the development of CO_2 lasers with continuous frequency tuning (CO_2 -CFT) is a topical problem. In this connection, a newly developed photoionization CO_2 -CFT laser of simple design and high operating reliability and safety is described. Its advantages over the existing types consist in a low level of operating voltage and a comparatively high efficiency. Formulas for selection and prediction of optimal parameters of the electric circuitry of superatmospheric-pressure CO_2 lasers are presented, and the possibility of utilizing high-voltage microsecond devices in CO_2 -CFT is demonstrated. Figures 3; references 13: 8 Russian, 5 Western.

[396-1386]

EFFECT OF THERMOOPTICAL PROPERTIES OF CRYSTALS ON THE SENSITIVITY OF THE INTERFERENCE METHOD OF MEASURING ABSORPTION IN THE IR REGION OF THE SPECTRUM

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 29-30 manuscript received 28 Jun 78

NOSOV, V. B.

[Abstract] The calorimetric interference method of measuring absorption in the IR region is characterized by the marked dependence of its sensitivity on thermo-optical properties of the materials examined. In this connection, that sensitivity has been tentatively compared for a number of promising infrared crystals such as LiF, NaF, NaCl, and others, as a function of their properties. A sensitivity comparison table for various crystals is presented with respect to two different methods of IR absorption measurement: the use of a two-beam interferometer, and the use of

interference of rays reflected from two surfaces of a plane specimen. The highest sensitivity of the method was recorded for KRS-5, KRS-6, ZnS, ZnSe, and CsI crystals, and the lowest, for AgCl, LiF, CaF₂ and SiO₂ crystals. Clearly, this is due to the lower specific heat of KRS-5, KRS-6, CsI, and CsBr, and certain other crystals, for which the rise in temperature will be several times as high as for SiO₂ and LiF crystals. It is this also that enhances the accuracy of absorption measurements. The practical applicability of the method was determined by measuring absorption indicators at 10.6 μ m wavelength in two specimens of single crystal zinc selenide that differed in thickness. Measurements by the interference method proved to be close to measurements performed by the thermocouple method. The sensitivity of temperature measurement by the interference method was about 0.05°C, which corresponds to an ± 0.0005 cm⁻¹ error of measurement of the absorption factor. It can be assumed that increasing the length of the zinc selenide specimen to 100 mm will enhance the sensitivity of the interference method of absorption measurement to the level of 10^{-4} - 10^{-5} cm⁻¹. References 12: 6 Russian, 6 Western.

[396-1386]

USSR

UDC 666.1.056.535.36

DIFFUSION OF LIGHT BY OPTICAL COATINGS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 31-33 manuscript received 17 Nov 77

SOKOLOVA, R. S., YEGORENKOVA, I. V. and RAZUMOVSKAYA, N. A.

[Abstract] The potential for reducing the diffusion of light by multi-layer optical coatings chemically deposited from hydrolyzing solutions was explored. Chemically deposited coatings are characterized by structural inhomogeneities as well as by inhomogeneities due to their manufacturing technology (inclusions, traces of grease, scratches, etc.). To increase their homogeneity they were produced in filtered-air (microclimate) premises as well as in a vacuum, and the substrates were cleaned prior to the deposition of coatings using filtered dehydrated ethyl alcohol. Discrete layers of oxides of thorium, zirconium, silicon, and their mixtures were investigated, as were various color-selective and specular coatings based on pure oxides. The light diffusion coefficient of the coatings was measured with the aid of an IOS-36 device. Coatings with an optical thickness of 150-200 nm (quarter-wave, for the visible region of the spectrum) were investigated. Zirconium dioxide coatings proved to be the most adversely affected by deviations from optimal microclimate standards, and titanium dioxide coatings, by the

increase in temperature of heat-treatment--their light diffusion coefficient then increased by a factor of 5-10 times. In multi-layer coatings consisting of as many as 15-25 layers and having an overall optical thickness of 2-3 μm the possibilities for the formation of structural inhomogeneities and defects are still greater and hence the various technological aspects of their production must be even more strictly controlled--the quality of air on the premises, the vacuum, the temperature of heat treatment, and the cleaning techniques. Under optimal manufacturing conditions the light diffusion coefficient of specular coatings consisting of alternating layers of titanium dioxide and silicon is as low as 0.02-0.05% and that of color-selective coatings, \sim 0.01-0.02%. The least diffusion of light is assured by the use of specular coatings based on dioxides of thorium and zirconium. Figure 1; references 6 Russian.

[396-1386]

USSR

UDC 778.38

A DEVICE FOR DEFLECTING A LASER BEAM BASED ON TRANSMITTING HOLOGRAMS

Moscow TEKHNIKA KINO I TELFVIDENIYA in Russian No 6, Jun 79 pp 43-45

ANTIPIN, M. V. and KISELEV, N. G., Leningrad Institute of Motion Picture Engineers

[Abstract] A simplified holographic laser beam deflector is proposed that is based on a flat backing with transmission holograms. Deflection non-linearity for this scanner is less than 1% over a beam angle of 32° with practically no curvature of the scanning line. A transparent disk carrying holograms on the rim is driven by an electric motor. A parallel laser beam is incident on the moving holograms at a 45° angle and is diffracted through a right angle, forming a parallel beam that is focused onto the photosensitive material being scanned. As the hologram moves, a single scanning line is produced on the material. An analysis is made of the coordinates of the beam vector, and of the angular displacement of the diffracted wave as the holographic deflector rotates. Experiments show that for practical use the diffraction efficiency must be increased to at least 50%, and distortions must be eliminated in the wave front of the diffracted beam. Figures 3, references 8: 2 Russian, 6 Western.

[302-6610]

USSR

UDC 533.922

EFFECT ON ANODE SPOTS ON THE CHARACTERISTICS OF A PLASMATIC ELECTRON
EMITTER WITH A CONSTRICTED ARC DISCHARGE

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3, May-Jun 79
pp 479-482 manuscript received 15 May 78

ZLOBINA, A. F., KAZ'MIN, G. S. and KREYNDEL', YU. YE., Tomsk Institute
of Automatic Control Systems and Radio Electronics

[Abstract] Plasmatic electron sources with constricted discharge arcs become eventually unstable when the discharge current is increased. An experimental study of this limitation on the electron emission capability was made with an argon plasma. The apparatus included cold cathodes in a magnetic field, an intermediate electrode and a main anode with a hole for letting the plasma enter from the constricted discharge chamber to an expander with a collector at the end. With a pilot discharge current of 20-50 μ A, the main discharge current could be varied from 5 to 50 A and instability was found to be caused by anode spots appearing on the main anode. Raising the spot threshold current seems to be the way to overcome the instability problem, which can be achieved by widening the stabilization channel in the intermediate electrode or by enlarging the hole in the main anode and thus lowering the arc glow voltage. The hole diameter must not exceed a certain optimum, however, lest breakdown occur within the acceleration gap. The spot threshold current in this experiment was 12 A for steel, 16 A for molybdenum and 20 A for titanium, with a foil of a given test material covering the ferromagnetic anode core. Figures 4; references 7: 4 Russian, 3 Western.

[385-2415]

USSR

UDC 621.375.8

SPECTRAL CONTENT OF RADIATION FROM A COPPER VAPOR LASER AND ITS EVOLUTION
IN TIME

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3, May-Jun 79
pp 483-489 manuscript received 9 Jun 78

BATENIN, V. M., KLIMOVSKIY, I. I., MOROZOV, A. V. and SELEZNEVA, L. A.,
Institute of High Temperatures, USSR Academy of Sciences

[Abstract] An experimental study of induced pulse radiation from a laser with self-limiting transitions was made, for the purpose of determining its spectral content and its evolution in time. Copper vapor served as

the laser source, in a 70 cm long active space and with a 1.2 cm wide discharge channel. Steady-state measurements were made with a Fabry-Perot interferometer crossing an ISP-30 spectrograph. Evolution of the pulse spectrum was recorded by passing the radiation through a pressure-scanned Fabry-Perot interferometer to an FEK-9 photocell. These dynamic measurements covered three modes of laser operation: with a mirror at one end and normal emission through the other, without a mirror and with superemission through both ends, with a mirror at one end and superemission through the other. Fluctuations of both the green line and the yellow line during a pulse were thus established and, contrary to theoretical calculations, the b-component of the hyperfine structure was found to appear before the a-component in both cases. Figures 6; tables 2; references 13: 9 Russian, 4 Western.

[385-2415]

USSR

UDC 537:524:5.536

PLASMOTRONS WITH DISCHARGE STABILIZATION BY INJECTION THROUGH A POROUS WALL

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3, May-Jun 79 pp 618-624 manuscript received 11 Sep 78

KARABUT, A. B., KUROCHKIN, YU. V., MEL'NIKOV, G. N. and PUSTOGAROV, A. V., MOSCOW

[Abstract] An effective method of raising the efficiency of plasmotrons by forced interaction of the gas stream with the electric arc is stabilization of the arc discharge by intensive injection of the ionizing gas through a porous wall. Here the performance of an axial plasmotron with a porous channel between the electrodes was studied experimentally with air, nitrogen, or hydrogen as the working gas. Cylindrical interelectrode channels were studied with walls of various different porous materials (Al_2O_3 or AlN ceramics, 12Kh18N10T steel, tungsten, molybdenum, or chromium). Electrical characteristics were measured, namely the current-voltage curves and the dependence of the electric field intensity on the injection pressure, as well as the thermal characteristics. The latter included the dependence of the mean-mass gas temperature at the exit and of the thermal efficiency on the discharge current. Here the results are evaluated theoretically on the basis of heat balance in the channel and of flow in the thermal boundary layer. A distinguishing feature of such plasmotrons is an upper limit on both the discharge current and the channel pressure, determined by the heat resistance of the porous wall and the regeneration of radiant thermal fluxes. Figures 5; table 1; references 13 Russian.

[385-2415]

MECHANISM OF COOLING A GAS HEATED BY RADIATION FROM A CO₂ PULSE LASER

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3, May-Jun 79
pp 646-647 manuscript received 1 Feb 79

KLIMOV, V. D., KUZ'MENKO, V. A. and LEGASOV, V. A., Institute of Atomic Energy imeni I. V. Kurchatov

[Abstract] High-intensity ($2-10 \text{ MW/cm}^2$) CO₂ pulse ($10 \mu\text{s}$ duration) lasers emitting radiation at infrared wavelengths are used for both theoretical and practical experiments. A gas mixture is heated by resonance absorption of this radiation and at the same time cooled by contact with the ambient medium. The mechanism of cooling is not heat conduction alone, because cooling rates have been found to be too high for that. Chemical reactions induced by radiation under pressure, their rates depending on the pressure, also contribute to the cooling process. Here the decomposition of ethyl acetate under these conditions was studied and the rate of this reaction measured. A CO₂ pulse laser (1039 cm^{-1} , close to the absorption band about 1050 cm^{-1}) was used for the experiment and the pressure of the reaction products found to increase almost linearly with the initial pressure of the mixture in a test cell exposed to 100 ns laser pulses. Figure 1; references 13: 7 Russian, 6 Western.

USSR

UDC 621.774.2

A TOOL FOR HELICAL FINNING OF TUBES

Moscow ENERGOMASHINOSTROYENIYE in Russian No 4, Apr 79 p 19

SLEPAK, E. S., candidate in technical sciences, STOYANOV, A. V., engineer, SHUL'MAN, I. YE, engineer, All-Union Planning-Design and Technological Institute of Atomic Boilers and Machinery, Scientific-Industrial Association Central Scientific Research and Technological Institute of Machines

[Abstract] A tool has been developed at the All-Union Scientific Research Institute of High-Frequency Currents imeni V. P. Vologodin, jointly with the All-Union Planning Design and Technological Institute of Atomic Boilers and Machinery and with the Central Scientific Research and Technological Institute of Machines, for helical finning of heat-exchanger water-economizer tubes. It is essentially a radio-frequency welder to which a tube is fed linearly in steps while being rotated at a controllable speed. The distinguishing feature of this tool is its adjustable chuck consisting of six feed rollers coupled through a universal joint and a distributor drive, with a centering device and a hydraulic pressure clamp. The tool is designed for tubes 16-60 mm in diameter and 1000-12,000 mm long. It welds on fins 4-25 mm high and 1-3 mm thick at a rate of 10-50 m/min. The variable electric drive has a power rating of 7.2kW and its speed can be regulated from 1.5 to 1500 rpm. Figures 3; tables 1.

[384-2415]

USSR

UDC 621.643/621.315.6

INSULATING PIPELINES UNDER WATER

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 6, Jun 79 pp 28-29

ZABELA, K. A. and ZNACHKOV, YU. K., Expeditionary Detachment of Underwater Technical Operations, Glavtransneft', Kiev

[Abstract] A method is described for applying insulation based on VAK polymer binder to underwater pipes. The reinforcing material (fiber-glass) is first treated with a solution of polybutyl methacrylate and methyl methacrylate to enhance wettability by the binder in a special device under water, and after wetting the material is applied to the surface to be insulated. A diagram is given showing the process of

fiberglass impregnation, and a device that combines the operations of wetting with the binder and application to the underwater pipe. The diver attaches the device to the pipe and sets it at the proper angle. Once insulation has been started, the device automatically wets the fiberglass with VAK and applies the impregnated insulation to the pipe as it is rotated, squeezing out the excess VAK as the work proceeds. At branches, fittings, flanges and so forth the diver uses only the wetting unit to saturate the fiberglass, and applies the treated insulation by hand. Figures 2.

[309-6610]

USSR

UDC 531.1

FORCED VIBRATIONS OF NONCONSERVATIVE ELASTIC SYSTEMS PASSING THROUGH RESONANCE

Kiev DOPOVIDI AKADEMIYI NAUK UKRAYINS'KOYI RSR, SERIYA A: FIZYKO-MATEMATYCHNI TA TEKHNICHNI NAUKY in Ukrainian No 8, Aug 79 pp 630-635 manuscript received 4 Nov 78

ZAHRORDYA, N. V., Kiev State University and KOVAL'CHUK, P. S., Institute of Mechanics, Academy of Sciences of the Ukrainian SSR

[Abstract] Vibrations of nonlinear nonconservative systems subject to external perturbations which vary in time and external forces which vary in space are considered, of particular interest being passage through the first resonance with attendant transients. The general solution to the fundamental system of differential equations of motion is applied, specifically, to an elastic system with two degrees of freedom such as a hinge-supported panel subject to flutter. Calculations, to determine locking into resonance and the stability limits, are performed by analog simulation. The article was presented by academician (Academy of Sciences of the Ukrainian SSR) I. I. LYASHKO. Figures 4; references 5: 4 Russian, 1 Western.

[400-2415]

USSR

UDC 539.3

STRESSED STATES AND THE EQUATIONS THAT DEFINE THEM IN CYLINDRICAL SHELLS WITH GENERAL ANISOTROPY

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR: MEKANIKA in Russian Vol 32, No 3, 1979 pp 26-41 manuscript received 26 Jul 78

KHACHATRYAN, SH. M., Institute of Mechanics, Academy of Sciences of the Armenian SSR

[Abstract] An examination is made of the problem of describing the stressed and strained state of a cylindrical shell made of a material that has general anisotropy. An asymptotic method proposed by A. L. Gol'denveyzer is used to construct iteration processes that describe possible stressed states in a cylindrical shell with index of variability less than unity. It is shown that determination of internal stressed states can be reduced to solution of a sequence of equations in which the first members coincide with the classical equations of shells that have a surface of elastic symmetry, while the boundary

stressed state (surface layer) is described by a sixth-order ordinary differential equation and does not resolve into plane and antipane boundary layers. Two-dimensional equations are proposed for simple determination of the stressed and strained state in a cylindrical shell with general anisotropy. The suitability of applied methods and the asymptotic method is discussed, and it is shown that applicability depends considerably on the relations between elastic coefficients. References 17: 14 Russian, 3 Western.

[308-6610]

USSR

UDC 539.3

ON THE STABILITY OF A COAXIAL SYSTEM OF SUPERCONDUCTIVE SHELLS

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR: MEKHANIKA in Russian Vol 32, No 3, 1979 pp 42-55 manuscript received 27 Feb 78

OVAKIMYAN, R. N., Institute of Mechanics, Academy of Sciences ArmSSR

[Abstract] An investigation is made of the mechanical stability of coaxial cables for superconductive transmission lines when they are subjected to the electromagnetic pressure that arises when the current flowing in the conductor interacts with the intrinsic magnetic field, without regard to the hydrodynamic pressure of the cryogenic coolant flowing in the annulus. The inner shell is assumed to be made of an elastically isotropic material with a given Young's modulus, Poisson ratio and density, and the outer shell is taken as absolutely rigid and nondeformable. Constant electric current flows through the superconductive outer layer of the inner shell. Because of superconductivity of the shells, the resultant magnetic field is set up only in the annulus. The resultant surface load on the inner shell is proportional to the linear current density and the surface flux density. An investigation is made of the stability of the inner shell under this load, and the critical value of this load (and hence the critical linear current density) is determined where the inner shell loses its initial circular shape. A dispersion equation is derived for the case of transverse electromagnetic pressure, and it is shown that a shell passing current is more stable than in the free state. Figures 2, references 8 Russian.

[308-6610]

DESIGN OF A SYSTEM FOR STABILIZING THE PLATFORM OF THE STEERING UNIT OF A TWO-REFLECTOR ANTENNA

Yerevan IZVESTIYA AKADEMII NAUK ARMYANSKOY SSR: SERIYA TEKHNICHESKIKH NAUK in Russian Vol 32, No 3, pp 44-53 1979 manuscript received 28 Jun 78

SARKISYAN, S. T., NERSESYAN, V. N. and MELKUMYAN, D. O., VNIIRI

[Abstract] A complex that includes a two-reflector spherical antenna with stationary main reflector and movable small reflector is considered. The small reflector is mounted on a metal tripod together with the driver. The deformations that arise due to weight, wind and temperature changes are compensated by a precision control system. The authors propose a design for one of the subsystems that automatically stabilizes the spatial position of the platform of the steering unit of the antenna. The platform position is adjusted by three screw mechanisms that move three points of the platform in the vertical direction. An error signal is produced when the platform deviates from the zero position, this signal is converted by a photoelectric sensor in a hydrostatic level and is then amplified and actuates a motor with gearbox that operates until the error signal disappears. The lag of a laboratory model designed for a platform 1 meter in diameter was 0.25 s. An examination is made of the transient process of the system considered as a multiply connected stabilization system with delays and nonlinearities. Figures 4, references 11: 10 Russian, 1 Western.

[307-6610]

MOTION OF CHARGED PARTICLES IN THE ELECTRIC FIELD OF AN m -PHASE RECTIFIER

Kishinev IZVESTIYA AKADEMII NAUK MOLDAVSKOY SSR in Russian No 1, 1979 pp 74-78

FURSOV, S. P., POPOVSKIY, M. V. and SEMENCHUK, A. V.

[Abstract] An examination is made of the motion of charged particles in an electric field created by half-wave and full-wave rectifiers that are special cases of a phase rectifier. It is shown that the magnitude of the pulsation of velocity and displacement of the particles and the coefficient of velocity pulsation depend on the field strength pulsation, which is determined by the rectifier circuit. An analysis is made

of circuits for a single-phase rectifier without a filter, an m-phase rectifier without filter and an m-phase rectifier with capacitive filter. The results enable determination of the nonuniformity of particle velocity that is caused by pulsations in the rectified voltage. Velocity pulsations can be reduced by increasing the frequency of the supply voltage and the number of rectifier phases, and by using a capacitive filter. Figure 1, references 4 Russian.

[306-6610]

USSR

UDC 521.1

PERTURBATIONS OF ANDOIS ELEMENTS IN A PROBLEM OF ROTATION OF A SOLID

Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR, SERIYA FIZIKO-TEKHNIЧЕСКИХ, ХИМИЧЕСКИХ I GEOLOGICHESKIKH NAUK in Russian No 4, 1979 pp 8-14 manuscript received 25 Jan 79

ZHELDAKOVA, L. V., Turkmen Polytechnic Institute

[Abstract] A triaxial solid whose center of inertia moves without perturbation in a Keplerian elliptical orbit around a central body is considered spinning about its own center of mass due to gravitational moments exerted by that central body. The spin motion is described by a system of six differential equations in six Andois osculating elements. With the force function determined approximately from relations for unperturbed motion, and including the second harmonic of the gravitational potential, the first-order perturbations of those elements are calculated by the method of a small parameter, this parameter here characterizing the relation between principal moments of inertia of the spinning solid with respect to different axes. The system of equations is reduced to standard form and its solution is sought in the form of series, according to the perturbation theory. The general results are then applied to Mars, with numerical data about its gravitational field supplied by satellites. Its procession constant is found to be $25'43''/100$ years, equivalent to one rotation of its spin axis about the normal to its orbital plane in 83,600 years. References: 7 Russian.

[386-2415]

USSR

UDC 629.195.1

PLANAR RESONANCE ROTATIONS OF A SATELLITE IN AN ELLIPTICAL ORBIT

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43, No 3, 1979
pp 401-410 manuscript received 5 Jun 78

BELETSKIY, V. V. and POGORELOV, D. YU., Moscow

[Abstract] Planar resonance rotations of a satellite in an elliptical orbit are investigated by the Poincare method. The equation of the planar oscillations of the satellite in an elliptical orbit is used to derive a quasilinear system with periodic solutions that can be stable only when the extremum represents the maximum. The resulting extremal principle is partly in agreement with the hypothesis of Beletskiy and Shlyakhtin (DOKL. AN SSSR, Vol 231, No 4, 1976) that a perturbing force function averaged over the exact solution of the quasilinear system with periodic solutions displays a maximum with respect to certain stable resonance motions. It is established that resonances of the $k:2$ type (where k is an integer) are determined by the first approximation with respect to a small parameter; resonances of the $k:4$ type, by the second approximation; and resonances of the $k:3$ and $k:4$ types, by the third. The effect of tidal forces in addition to gravity on the existence and stability of planar resonance rotations is investigated. Figures 5; references 16: 14 Russian, 2 Western.

[318-1386]

USSR

UDC 531.35+521.1

STEADY-STATE ROTATIONS OF A SOLID IN A PERIODIC ORBIT IN THE NEIGHBORHOOD OF THE COLLINEAR LIBRATION POINT

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43, No 3, 1979
pp 411-418 manuscript received 15 Jul 78

MARKEYEV, A. P., Moscow

[Abstract] The rotational motion of a dynamically symmetric solid whose center of mass moves in a periodic orbit in the neighborhood of the collinear libration point L_2 of the limited circular three-body problem is investigated. The motion occurs under the influence of gravitational moments due to material points m_1 and m_2 . The linear dimensions of the solid are small compared with the distances from its center of mass O to points m_1 and m_2 , and hence it is assumed that the motion of the

solid relative to its center of mass 0 does not affect the motion of the center of mass itself. The orbit of the center of mass 0 of the solid is described within the framework of the limited circular three-body problem (more exactly, the three-point problem-- m_1 , m_2 , and 0). In this case m_1 and m_2 represent Earth and the Moon. It is assumed that the periodic orbit of the solid's center of mass represents a segment of a straight line running at right angles to the plane of rotation of the masses exerting gravitational pull and that this line passes through the collinear libration point. Two types of steady-state rotations of the solid in an orbital coordinate system are derived and their stability is investigated. Figure 1; references 5: 4 Russian, 1 Western.

[318-1386]

USSR

UDC 531.38

THE BIFURCATION SET AND INTEGRAL MANIFOLDS OF THE PROBLEM OF THE MOTION OF A SOLID IN A LINEAR FORCE FIELD

Moscow PRIKLADNAYA MATEMATIKA I MEKHANIKA in Russian Vol 43, No 3, 1979
pp 419-428 manuscript received 2 Apr 78

POGOSYAN, T. I. and KHARLAMOV, M. P., Donetsk

[Abstract] The integrable problem of the motion of a solid with a stationary center of mass in a force field, induced by a gravity-exerting material point, is investigated. The solid is linked to a cartesian coordinate system with axes directed along the major central axes of inertia. The ellipsoid of inertia is assumed to be triaxial. The corresponding bifurcation set representing the totality of critical values of integral mapping is constructed. The type of integral manifolds in nondegenerate cases is indicated. The proposed method advances phase topology in cases in which the center of mass coincides with a fixed point. Figures 3; references 9: 8 Russian, 1 Western.

[318-1386]

STABILITY OF MOTION WITH RESPECT TO SOME OF THE VARIABLES FOR CERTAIN NONLINEAR SYSTEMS

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43, No 3, 1979
pp 441-450 manuscript received 10 Mar 78

VOROTNIKOV, V. I., Moscow

[Abstract] Criteria of stability and instability of unperturbed motion with respect to some of the variables are derived with respect to nonlinear systems on the basis of a method proposed in an earlier investigation (Vorotnikov, V. I. and Prokof'yev, V. P., PMM, Vol 42, No 2, 1978) with respect to linear systems. This approach offers a solution to problems of asymptotic stability and instability with respect to some of the variables as well as to the problem of stability of motion in the critical case of a single zero, and it also offers a solution to the problem, posed here, of the absolute stability of motion with respect to some variables for nonlinear controlled systems. Examples of nonlinear systems are presented to show that the stability domain of separately specified coordinates can be broader than the stability domain of all the coordinates characterizing the system state. References 9 Russian.

[318-1386]

CONVERGENCE OF THE SOLUTION OF THE LINEAR SINGULAR-PERTURBATION FAST-MODE PROBLEM

Moscow PRIKLADNAYA MATEMATIKA I MEKhanika in Russian Vol 43, No 3, 1979
pp 466-474 manuscript received 18 Apr 78

GICHEV, T. R. and DONCHEV, A. L., Sofia

[Abstract] The problem of rapidity of operation is considered for a controlled system described by a differential vector equation. The problem consists in finding an admissible control mode for bringing the system from some initial space to the coordinate origin O_n of the space R^n within the minimum possible time. The effect of singular perturbations on the problem is considered. The convergence of the solution of the problem with the solution of the problem of rapidity of operation for a reduced system is explored with the aid of Pontryagin's maximum principle. References 8: 3 Russian, 3 Bulgarian, 2 Western.

[318-1386]

USSR

UDC 539.433+534.1

EVALUATION OF THE INTENSITY OF QUASI-HARMONIC LOADS IN TURBOMACHINES

Kiev PROBLEMY PROCHNOSTI in Russian No 8, Aug 79 pp 20-24 manuscript received 26 Apr 77

SIDORENKO, M. K., Kuybyshev Institute of Aviation

[Abstract] Final reinforcement of turbomachinery prior to operation must provide protection against dynamic loads which will cause vibration. Such loads are generally not harmonic, but here their effect is evaluated in terms of a narrow-band random quasi-harmonic model. The analysis is based on the transfer function for a structure generally corresponding to a multidimensional linear system, and specifically a beam on two bearings, with random pressures at the input and random stresses at the output. Calculations reveal that, while some acceleration amplitude can be found which is equivalent to a distributed force load, only an equivalent velocity amplitude will be directly proportional to the width of the stress spectrum in any vibration mode and not dependent on the dynamic characteristics of the structure. This velocity amplitude should, therefore, serve as the criterion of load and vibration intensity. Figures 4; references: 5 Russian.

[397-2415]

USSR

UDC 539.3:534.1

A PLATE UNDER THE ACTION OF A SPHERICAL SHOCK WAVE

Kiev PROBLEMY PROCHNOSTI in Russian No 7, Jul 79 pp 108-111 manuscript received 28 Jul 77

YAKUPOV, R. G., Ufa Aviation Institute

[Abstract] An examination is made of the action of a blast wave on rectangular and circular plates of constant thickness fastened around the edge on rigid and stationary supports. The space on one side of the plate is filled with a dense medium, and on the other side with an ideal compressible fluid. It is assumed that an explosive charge is detonated in the dense medium, resulting in a spherical plastic shock wave that is incident on the plate and is reflected from the plate. The stresses and flexures produced in the plate are calculated. Flexures are found as a series expansion with respect to eigenfunctions. The equations of motion of the plate are solved by the Bubnov-Galerkin method. A numerical example is considered, and graphs are presented for the flexures and stresses. Figures 3, references 5 Russian.

[293-6610]

USSR

UDC 412:620.713.2

A METHOD OF CALCULATING THIN-WALLED LARGE-DIAMETER RIBBED PIPES

Kiev PROBLEMY PROCHNOSTI in Russian No 7, Jul 79 pp 104-108 manuscript received 14 Jun 78

TSOY, N. G., KOLESNIKOV, A. V. and BOGDANOV, V. G., Voroshilovgrad Machine Building Institute

[Abstract] A comparative study is done on the load-bearing capacity of isotropic and orthotropic fiberglass thin-walled large-diameter pipes with ribbed reinforcement with pressurized and vacuum methods of wind loading. In the former case the pipes work on internal pressure distribution, and in the second case on external pressure distribution. The reinforcement was in a longitudinal-transverse arrangement produced by wet filament winding. Expressions are derived for the critical distributed pressures based on maximizing stresses to get the calculated long-term strength, and for the optimum spacing between ribs for maximum load-bearing capacity. Figures 4, references 9 Russian.

[293-6610]

USSR

UDC 534.12

DETERMINATION OF FREQUENCIES AND FORMS OF NATURAL OSCILLATIONS OF STRATIFIED PLATES UNDER COMPLEX BOUNDARY CONDITIONS BY THE NET-POINT METHOD

Kiev PROBLEMY PROCHNOSTI in Russian No 7, Jul 79 pp 97-99 manuscript received 22 May 78

ANTONENKO, V. M., PISKUNOV, V. G. and STEPANOVA, A. YE., Kiev Vehicle and Road Institute

[Abstract] A net-point method is used to study vibration of plates. An iteration algorithm is proposed for determining all eigenvalues and their corresponding eigenvectors in a matrix of a system of finite-difference equations giving the frequencies and modes of oscillations. Multilayered plates are considered with boundary conditions corresponding to hinging, clamping and various combinations of the two. Calculations on the YeS-1022 computer for rectangular plates show that the algorithm is adequately accurate and effective for determining the lower frequencies of natural oscillations. Figures 1, references 8: 7 Russian, 1 Western.

[293-6610]

USSR

UDC 624.074.4.075.042.5:681.3

INVESTIGATION OF THE THERMAL STABILITY OF REINFORCED SHELLS OF REVOLUTION

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 3 (113)
Jun 79 pp 33-38

KURANOV, B. A., candidate of technical sciences, and SAMARIN, A. V.,
engineer, Kriogenmash Scientific Production Association, Balashikha

[Abstract] In the case of unsteady conditions of heating and cooling of cryogenic equipment, or in accidents where a cryoproduct comes into contact with a heated surface, considerable temperature gradients and thermal stresses may arise. The authors discuss a modification of the finite element method as applied to problems of the thermal stability of reinforced shells subjected to axisymmetric combined loading by temperature and external forces with arbitrary variation with respect to length of the shell. The problem of determining thermal stability is solved in two stages: determination of the stressed and strained state of the shell under the action of external and temperature loads, and then construction of a matrix of bending stiffnesses and matrices of geometric stiffnesses for a certain type of loss of stability. Examples are given and the accuracy of the technique is evaluated. Figures 7, references 11 Russian.

[310-6610]

USSR

UDC 624.074.4.075.04:681.3

STABILITY OF A CYLINDRICAL SHELL PARTLY FILLED WITH AN ELASTIC BODY

Moscow STROITEL'NAYA MEKHANIKA I RASCHET SOORUZHENIY in Russian No 4 (124),
Aug 79 pp 37-40

MALYUTIN, I. S., candidate of physical and mathematical sciences, and
TARASOVA, A. G., engineer, Moscow

[Abstract] An examination is made of the stability of an orthotropic cylindrical shell partly filled with an elastic body of cylindrical shape under the action of initial zero-moment annular and axial forces that vary along the generatrix of the shell in the general case. Deformation of the filler is described by equations of elasticity theory. The shell is assumed to be reinforced by annular ribs. The analysis is based on the Bubnov-Galerkin method realized on a digital computer. An example is given. The results agree satisfactorily with experimental data. Figures 2, references 4: 3 Russian, 1 Western.

[311-6610]

EFFECT OF A BLAST WAVE ON A SPHERICAL PANEL

Moscow STROITEL'NAYA MEKhanika I RASCHET SOORUZHENIY in Russian No 4 (124),
Aug 79 pp 40-43

YAKUPOV, R. G., candidate of technical sciences, Ufa Aviation Institute
imeni Ordzhonikidze

[Abstract] Stresses and strains are determined in a nearly flat spherical panel in a continuous medium that transmits an explosive plastic wave with a plane front and with a spherical front. A numerical example is given for the plane wave front with curves plotted for the deflection in the center of the panel as a function of time. Figure 1, references 11 Russian.

[311-6610]

USSR

UDC 621.313.12:538.4

TURBULIZATION OF A PLASMA IN THE COMBUSTION CHAMBER OF AN MHD-GENERATOR

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3, May-Jun 79
pp 611-617 manuscript received 3 Jul 78

BYSTRYY, A. I. and GANAFEL'D, R. V., Institute of Electrodynamics, Academy of Sciences of the Ukrainian SSR

[Abstract] Fluctuations of plasma emissivity during combustion are analyzed, such fluctuations being still intensive after suppression of low-frequency instability in the combustion chamber of an open-cycle MHD generator with direct mixing of fuel and oxidizer. The analysis is based on the approximate thermal model with a single equation of heat conduction. It is also based on experimental data pertaining to homogeneous combustion with disk mixers and to diffusive combustion with a pylon feeder-stabilizer. Measurements were made with DJSA equipment for analysis of random processes. The evolution of turbulence along the plasma channel indicates a much lower fluctuation intensity in the case of homogeneous combustion, inasmuch as the main source of turbulence in combustion products is spontaneous turbulization of the flame and that determines the scales as well as the spectra of plasma fluctuations. The results indicate, furthermore, that the intensity of combustion instability decreases with higher combustion intensity. Homogeneous combustion would thus be most appropriate for MHD generators, but is not feasible yet on account of flame jumping through to uncoolable mixer compartments. Increasing the feed rate of reactants has not proved to be an effective solution to this problem. Figures 6; tables 1; references 13: 11 Russian, 2 Western.

[385-2415]

USSR

UDC 538.4

EQUIVALENT ELECTRICAL CIRCUITS OF AN MHD-GENERATOR CHANNEL

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3,
May-Jun 79 pp 626-631 manuscript received 12 Oct 78

BLITSHEYN, A. A., GUSEV, YU. P., PISHCHIKOV, S. I. and PISHCHIKOV, V. I.,
Institute of High Temperatures, USSR Academy of Sciences

[Abstract] Equivalent electrical circuits of MHD generators are derived which take into account the Hall effect and represent it by dependent emf sources. They are based on Ohm's law, assuming a low magnetic

Reynolds number and no ion slip. This equation is first integrated for an elementary plasma cell, the latter subdivided into upper and lower halves as well as into right-hand and left-hand halves. The resulting linear algebraic equations with proper coefficients are then extended to an MHD channel with a multilayer flow. The problem of calculating the branch currents and node potentials reduces to the problem of finding a common point of two linear manifolds in the $\{\varphi, I\}$ -space. Matrix calculus is applied here and an iterative algorithm is developed which includes the appropriate boundary conditions. The equivalent circuit configuration depends neither on the load nor on the arrangement of electrodes, but it correctly interprets the distributions of gas dynamic parameters and of the magnetic field. The authors thank S. A. MEDIK and V. I. KOVBASYUK for their interest in this study. Figures 4; references: 6 Russian.

[385-2415]

USSR

UDC 621.039.526:681.142.2

CALCULATION OF THE EFFECTIVENESS OF MULTIZONE CONTROL RODS WITH ALLOWANCE FOR THE ABSORPTION OF MODERATE NEUTRONS

Minsk IZVESTIYA AKADEMII NAUK BSSR, SERIYA FIZIKO-ENERGETICHESKIKH NAUK
in Russian No 3, 1979 pp 20-24 manuscript received 5 Jul 78

LUKHVICH, A. A. and RUBIN, I. YE., Institute of Nuclear Energetics, BSSR
Academy of Sciences

[Abstract] In modern power reactors the design of control rods is becoming increasingly complicated. Hence calculations of engineering physics should allow for rods consisting of several physically heterogeneous zones so as to allow for the moderation and absorption of neutrons in the different rod zones with respect to the real spectrum of the neutrons incident from the reactor core. In this connection, a procedure for interrelated calculation of the spatial and energy distribution of fluxes in the reactor and in the rod is presented. The mean group fluxes in the rod zones and the extrapolation length are determined by the albedo method, while the spatial dependence of the group fluxes in the reactor is determined by the method of the factorization of finite-difference diffusion equations. Such a combination of methods does not require any considerable expenditures of computer time. The calculations were experimentally verified for control rods used in a uranium-water critical assembly and positioned at the center of a cylindrical core, and were found to coincide with experiment correct to $\pm 5\%$. It should be noted that whereas in this case neutron moderation hardly affects rod effectiveness, moderation can affect markedly rod effectiveness in fast reactors and upon use of hydrogenous moderators. Thus, calculations of a fast reactor with a central rod of natural boron carbide show that rod effectiveness is $\approx 13\%$ higher when allowance is made for moderation by nuclei of boron and carbon. References 12: 10 Russian, 2 Western.

[399-1386]

MAIN TRENDS IN THE DEVELOPMENT OF ATOMIC ENERGY

Minsk IZV. VUZ: ENERGETIKA in Russian No 5, May 79 pp 44-50 manuscript received 4 Jun 76

IVANOV, V. A., doctor of technical sciences, professor, REMZHIN, YU. N., candidate in technical sciences, SHCHEDROV, V. B., candidate in technical sciences, lecturer, "Order of Lenin" Leningrad Polytechnic Institute imeni M. I. Kalinin All-Union State Institute for Planning of Electrical Equipment for Heat Engineering, Leningrad branch

[Abstract] Intensive development of atomic energy during the 1976-80 period, primarily in the European part of the Soviet Union, follows the decisions by the 25th CPSU Congress. The main trends of this development involve thermal reactors and fast reactors. Reactors on thermal neutrons include pressurized water-moderated water-cooled ones such as the 3,000 MW VVER-1000 unit with four steam generators (420 kg/s under 6.5 MPa pressure) and two 500 MW turbines installed at the Novo-Voronezh atomic electric power plant, and water-graphite channel reactors such as the 3,200 MW RBMK-1000 unit with a drum separator installed at the Leningrad atomic electric power plant. These reactors, particularly the VVER-1000 are also considered for use in central heating. Reactors on fast neutrons include the BR-5 in Obninsk, the BOR-60 in Dmitrovgrad and the 350 MW unit in Shevchenko. A 3-stage BN-600 is being installed at the Beloyarsk atomic electric power plant, with liquid sodium in the first two stages and a nonradioactive coolant in the third stage. Selection of the coolant is a major problem. Gas-cooled fast reactors with helium, carbon dioxide, or dissociating nitrogen tetroxide as the coolant are also under consideration. Major concerns associated with the mushrooming of atomic electric power plants are their maneuverability, reliability and safety. In recent years (1974-76) the average failure rate has decreased from 1.2 to 0.2 a year. References 19 Russian.

[391-2415]

SELECTION OF EFFICIENT STEAM-TURBINE CYCLES FOR ATOMIC ELECTRIC POWER PLANTS WITH GAS-COOLED FAST REACTORS

Minsk IZV. VUZ: ENERGETIKA in Russian No 5, May 79 pp 50-54 manuscript received 12 Sep 78

KLOK, A. M., candidate in technical sciences, ANISIMOVA, N. F., engineer, GRIBOVSKIY, V. P., engineer, Chair of Atomic Electric Power Plants, "Order of Labor's Red Banner" Odessa Polytechnic Institute

[Abstract] An important feature of atomic electric power plants with fast reactors is the low fuel component of the total energy cost. Nevertheless, efficiency is still a major economic factor in plant operation. More attention is now paid, on this account, to gas-cooled fast-breeder reactors. Design and performance calculations include selecting the thermodynamic cycle and determining the optimum mean-thermodynamic heat supply temperature. Here an algorithm of cycle selection on the basis of energy and material balance is shown which correlates with the temperature-enthalpy diagram. Typical results are obtained for a 2-stage steam-power cycle with either two pressures or only one pressure in the first stage, namely the overall efficiency as a function of the power lost on pumping the heat carrier. As this power is increased, the overall efficiency tends to decrease accordingly. On the other hand, however, the resulting higher temperature of the coolant at the reactor exit tends to increase the overall efficiency. At some pumping power, therefore, the overall efficiency will be maximum. This maximum decreases and shifts to higher pumping power with increasing pressure of the coolant. The established relations indicate that, with helium used as the coolant, a first stage with only one pressure is preferable. Figures 2; references 6 Russian.

[391-2415]

BINARY CYCLE IN ATOMIC ELECTRIC POWER PLANTS WITH HIGH-TEMPERATURE REACTORS

Minsk IZV. VUZ: ENERGETIKA in Russian No 5, May 79 pp 5-61 manuscript received 27 Jun 78

GOKHSHEYN, D. P., doctor of technical sciences, professor, Chair of Atomic Electric Power Plants, "Order of Labor's Red Banner" Odessa Polytechnic Institute

[Abstract] The feasibility of dual-purpose high-temperature gas-cooled reactors, generating power and producing a high-temperature heat transfer agent for metallurgical and chemical industries, has already been

established on the basis of 950°C being a safe temperature of helium near fuel elements operating at 1300°C . Here the performance of such reactors for power generator is evaluated with four different cycles: 1) helium-steam binary cycle with an extra helium compression process, 2) plain steam cycle with helium used for preheating (two loops), 3) plain helium cycle with three compression stages (single loop), 4) helium-steam binary cycle without extra helium compression. Thermodynamic calculations based on typical operating parameters indicate that the fuel economy with the first variant is 10-11% better than with the second or the fourth variant and the overall efficiency with the first variant is 16 percentage points better than with the third variant, assuming in each case the same helium temperatures at the reactor entrance and exit as well as at the entrance to the main compressor. This beneficial net effect of the extra compression on the fuel economy is attributable to the fact that the added exoergic losses are smaller than the resulting reduction of exoergic losses due to heat transfer. Figures 4; tables 2; references: 4 Russian.

[391-2415]

AN ATMOSPHERIC TRANSMITTANCE METER

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 24-25 manuscript received 16 Nov 77

FILIPPOV, V. L., MAKAROV, A. S., MIRUMYANTS, S. O., SOLOV'YEVA, K. S.,
FEDOT'YEVA, R. V., ALEKSASHINA, E. M. and KEL'DIVATOV, A. F.

[Abstract] The principal specifications of a filter-type absolute atmospheric transmittance meter recommended as the basic device for mass measurements of optical density of the atmosphere in the "transmission windows" are presented. Spectral scanning by means of this device is accomplished by means of a system of interference filters with transmission bands corresponding to atmospheric transmission windows of 0.55, 0.815, 1.05, 1.24, 1.63, 2.26, 3.97, 10.1, and 11.1 μm . The meter contains two channels: an operating channel, in which optical radiation intersects the medium being investigated, and a reference channel whose short extent serves to disregard the attendant radiation attenuation. The relative spectral width of the interference filters $S\lambda_{0.5} \approx 0.01$ serves to virtually completely preclude the distortion of meter readings due to the molecular absorption of radiation by the spectral lines of atmospheric gases, and analysis warrants recommending the use of interference filters with $S\lambda_{0.5} \approx 0.02$. Recording time per spectrum is 2 s and the error of discrete measurement does not exceed 2%. Figures 2; references 5 Russian.

[396-1386]

MACHINING OF STRONTIUM TITANATE CRYSTALS

Leningrad OPTIKO-MEKHANICHESKAYA PROMYSHLENNOST' in Russian No 6, 1979
pp 33-35 manuscript received 29 Dec 77

KUKLEVA, Z. A. and KOZHUKHOVA, V. T.

[Abstract] Components made from crystals of strontium titanate SrTiO_3 find increasing application in optical systems. This new expensive cubic-system crystal with a Moos hardness of 6-6.5, density of 5.12 g/cm^3 , and melting point of 2080°C, displays high mechanical properties which necessitate its prolonged machining: these crystals take 4-5 times as long to polish as does conventional K8 silicate glass. In view of the scarcity of published literature on the machining of these crystals to assure optical precision and clean surface, crystal specimens measuring

12 mm in diameter and 10 mm in thickness were tentatively subjected to various grinding and polishing techniques. It was established that the crystals are amenable to high-speed grinding (at a tool feed rate of 0.2 mm/min) by means of A 125/100 grain and ASM 14/10 grain diamond abrasive tools: grinding time is then reduced to one-half or one-third compared with conventional grinding methods. As for polishing, the chemico-mechanical method for polishing the crystals with the aid of a wetting mixture of 5% acids (fluoric and nitric) in a ratio of 1:1 in the presence of ASM 1/0 diamond powder reduces polishing time of the crystals by a factor of 2.5-3.5 times compared with the conventional method; then a high quality of the polished surface and precision of shape is also achieved. Figure 1; references 5: 1 Russian, 4 Western.

[396-1386]

USSR

UDC 669.295.7+621.430+669.0.11

INVESTIGATION OF THE HIGH-TEMPERATURE STRENGTH PROPERTIES OF ST1 TITANIUM ALLOY AND 4Kh10S2M STEEL AS APPLIED TO CONDITIONS OF OPERATION OF DIESEL ENGINE VALVES

Kiev PROBLEMY PROCHNOSTI in Russian No 7, Jul 79 pp 114-116 manuscript received 3 Jul 78

ZAIKIN, YU. K., NARTOVA, T. T., VOLYNSKIY, V. V. and KRYUKOVSKIY, V. V., Zaporozh'ye

[Abstract] Comparative studies are done on the thermal stability, heat resistance, long-term strength and creep of ST1 titanium alloy and 4Kh10S2M steel. Thermal stability was determined by studying the strength limit and ductility properties of specimens at room temperature after holding for 100 hours at temperatures of 300-800°C. Heat resistance was determined from measurements of gas corrosion at temperatures of 500, 600, 700 and 800°C by a gravimetric method. Holding time at these temperatures varied from 20 to 100 hours. Long-term strength was determined on VPZ machines at test temperatures of 600 and 700°C. Creep was studied by bending on a centrifugal machine, and also by a standard technique on a standard machine. The stability of mechanical properties during long-term heating was studied in the 300-800°C range from measurements of the change in ultimate strength and yield point, relative longitudinal extension and lateral contraction. The results show that the titanium alloy is better than the steel in high-temperature strength properties. ST1 alloy is recommended for internal combustion engine valves. References 4 Russian.

[293-6610]

A UNIVERSAL SCHEME FOR MEASURING THE TEMPERATURE OF A GAS BY THE METHOD
OF INVERTING THE SPECTRAL LINES

Moscow TEPILOFIZIKA VYSOKIKH TEMPERATUR in Russian Vol 17, No 3, May-June 79
pp 598-604 manuscript received 10 May 78

SMEKHOV, G. D., POLTORATSKIY, V. A. and BRITAN, A. B., Institute of
Mechanics, Moscow State University

[Abstract] One method of measuring the temperature of a gas is to use a reference source with a continuous radiation spectrum in the background and to record the instant at which the spectral line of the gas merges with that spectrum. Here this method is modified so as not to require that the angular apertures of the luminous fluxes from the image of the source and from the radiation emitting gas be equal. This scheme is based on the relations for the intensity of radiation from a plane surface and from a plane gas layer respectively. An expression for calculating the gas temperature is derived therefrom which contains only the ratio of flux intensities, the ratio of geometrical factors, the radiation quantum at the center of the spectral interval, and the temperature of the reference source. This method was checked out experimentally by heating a $\text{CO}_2 + \text{N}_2 = 15.8\%$ mixture with a shock wave and measuring the temperature through a slotted-disk modulator, with a hollow graphite rod approximating a black body as the reference source. It was found necessary to correct the ratio of geometrical factors, but the resultant error due to random variations of all parameters did not exceed 5%. The authors thank S. A. LOSEV for discussing the results. Figures 4; references 11: 9 Russian, 2 Western.

[385-2415]

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